

Wide Operating Temperature Range Ruggedized Ultracapacitor For Deep Space Exploration, Phase I

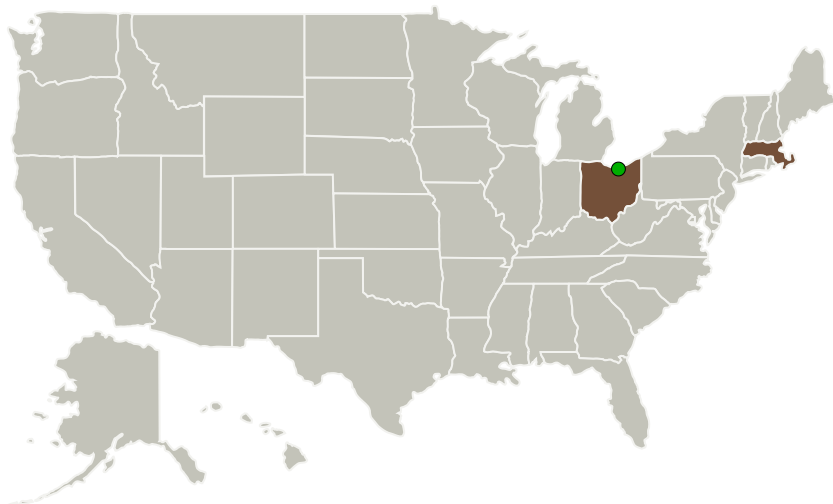
Completed Technology Project (2015 - 2015)



Project Introduction

A Carbon Nanotube (CNT) ultracapacitor capable of operating from the extreme low temperature of -110°C , up to 80°C will be developed. Traditional ultracapacitors exhibit limited operating temperature ranges due to use of high melting point and volatile electrolytes, and activated carbon electrodes. During Phase I, we will demonstrate a new low melting point ionic liquid based electrolyte and engineered CNT electrodes for high power and energy density retention at temperature extremes. The proposed ultracap will enable significant improvements in spacecraft avionics, launch vehicles, rovers and landers – reducing weight, volume and complexity while improving performance and relaxing design constraints on traditional battery technologies. At the end of Phase II, this device will deliver a high peak power density of (10kW/kg and 14kW/L) and an energy density of (8Wh/kg and 11Wh/L) over this broad temperature range. The prototype will have a cycle life of 1,000,000 cycles at room temperature and below, and more than 100,000 cycles at 80°C . Further, the device will be engineered to withstand high shock (up to a 1000Gpeak) and vibration (up to 60 Grms) conditions. In applications where long-lived energy storage devices are critical, dramatic reductions in total weight and volume can be achieved by pairing batteries with the proposed ultracap technology.

Primary U.S. Work Locations and Key Partners



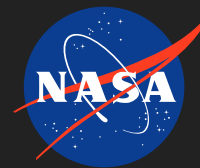
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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
FastCAP Systems Corporation	Lead Organization	Industry	Boston, Massachusetts
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Massachusetts	Ohio
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Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: Wide Operating Temperature Range Ruggedized Ultracapacitor For Deep Space Exploration, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/139552>)

Images



Briefing Chart Image

Wide Operating Temperature Range Ruggedized Ultracapacitor For Deep Space Exploration, Phase I
(<https://techport.nasa.gov/image/135756>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

FastCAP Systems Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

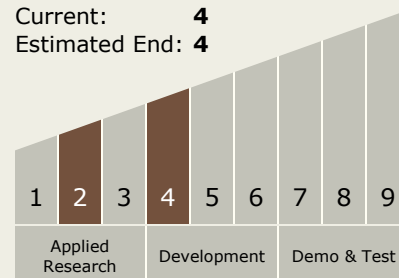
Carlos Torrez

Principal Investigator:

Riccardo Signorelli

Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.2 Energy Storage
 - └ TX03.2.3 Advanced Concepts for Energy Storage

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System